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EXAMINER

KIELIN, ERIK J

ART UNIT PAPER NUMBER

2813

DATE MAILED: 08/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/670,975

Applicant(s) *NC*

MAY ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 26 June 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 9-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 September 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

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## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election of claims 1-8 in Paper No. 8 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 4, 7, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,200,023 (**Gifford et al.**).

Regarding claim 1, **Gifford** discloses a method for controlling a substrate temperature of a substrate **26** during processing of the substrate at a process energy ("RF power" for etching; col. 5, lines 54-59), by controlling a chuck temperature (called "wafer electrode **36**") of a chuck on which the substrate resides during the processing, comprising:

circulating a thermal transfer media at a thermal transfer media temperature through the substrate chuck to adjust both the chuck temperature and the substrate temperature, the thermal transfer media circulating at a flow rate (Abstract; col. 7, lines 37-54);

sensing the chuck temperature from at least one chuck temperature sensing location at the chuck, as well as globally (col. 6, lines 55-59; col. 7, lines 26-29 and lines 40-44);

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reporting the sensed chuck temperature to a controller, where the controller is operable to adjust the process energy and at least one of the thermal transfer media flow rate and the thermal transfer media temperature (col. 5, lines 54-59; col. 7, lines 47-54); and

when the sensed chuck temperature is outside of a desired temperature range, then using the controller to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to bring the sensed chuck temperature within the desired temperature range (col. 5, lines 54-59; paragraph bridging cols. 5-6; col. 7, lines 47-54; Figs. 3a through 4b).

Regarding claim 2, the chuck temperature is sensed from three different locations at the chuck (col. 7, lines 26-29 and lines 40-44).

Regarding claim 4, the chuck temperature is sensed from locations on a surface of the chuck disposed adjacent the substrate (col. 7, lines 26-29 and lines 40-44).

Regarding claim 7, the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to cool the chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 7, lines 26-29 and lines 40-44).

Regarding claim 8, the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to heat the chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 7, lines 26-29 and lines 40-44).

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4. Claims 1-3, 5, 7, and 8 rejected under 35 U.S.C. 102(b) as being anticipated by US 5,591,269 (**Arami et al.**).

Regarding claims 1-3, **Arami** discloses a method for controlling a substrate temperature (col. 2, lines 44-47) of a substrate **W** (Fig. 18) during processing of the substrate at a process energy **130, 131, 132**, by controlling a chuck temperature of a chuck (Abstract) on which the substrate resides during the processing, comprising:

circulating a thermal transfer media **115, 151** at a thermal transfer media temperature through the substrate chuck to adjust both the chuck temperature and the substrate temperature, the thermal transfer media circulating at a flow rate (Fig. 18; col. 16, lines 29-48);

sensing the chuck temperature from three chuck temperature sensing locations **152, 153, 154** within the chuck -- as further limited by instant claims 2 and 3 (Fig. 18);

reporting the sensed chuck temperature to a controller **119**, where the controller is operable to adjust the process energy **130, 131, 132** and at least one of the thermal transfer media flow rate and the thermal transfer media temperature (col. 9, lines 11-24); and

when the sensed chuck temperature is outside of a desired temperature range, then using the controller to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to bring the sensed chuck temperature within the desired temperature range (col. 9, lines 11-24).

Regarding claim 5, the method of claim 1 wherein the desired temperature range is between about fifty centigrade and about five hundred centigrade (col. 18, lines 3-12).

Regarding claim 7, the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to cool the

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chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 9, lines 11-24).

Regarding claim 8, the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to heat the chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 9, lines 11-24).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,605,600 (**Muller et al.**) in view of **Arami**.

Regarding claims 1-3, **Muller** discloses a method for controlling a substrate temperature (col. 1, lines 43-55) of a substrate **104** (Fig. 4) during processing of the substrate at a process energy ("RF power" for etching; col. 2, lines 7-26), by controlling a chuck temperature of a chuck **105** on which the substrate resides during the processing, comprising:

circulating a thermal transfer media at a thermal transfer media temperature through the substrate chuck to adjust both the chuck temperature and the substrate temperature, the thermal transfer media circulating at a flow rate (col. 1, line 56 to col. 2, line 6; col. 2, lines 27-41);

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sensing the wafer temperature from at least one wafer temperature sensing location at the chuck, (Fig. 3);

reporting the sensed chuck temperature to a controller, where the controller is operable to adjust the process energy and at least one of the thermal transfer media flow rate and the thermal transfer media temperature (col. 5, lines 54-59; col. 7, lines 47-54); and

when the sensed chuck temperature is outside of a desired temperature range, then using the controller to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to bring the sensed chuck temperature within the desired temperature range (col. 5, lines 54-59; paragraph bridging cols. 5-6; col. 7, lines 47-54).

While **Muller** is silent to means of sensing the temperature of the wafer, **Arami**, as noted above, discloses an electrostatic chuck for controlling the temperature of a semiconductor wafer and teaches the benefits of measuring the wafer temperature using three locations from within the chuck in order to get better uniformity and control of the wafer temperature (**Arami**, col. 2, lines 44-47).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to measure the temperature of the chuck from three locations within the chuck in the method of **Muller**, in order to obtain more thorough information of the wafer temperature for better control of the process, as taught by **Arami**.

Regarding claim 5, **Muller** discloses that an exemplary desired temperature range is 145 °C (col. 3, lines 48-52), which is between about 50 °C and about 500 °C.

Regarding claim 6, **Muller** discloses that the controller first attempts to bring the sensed temperature within the desired temperature range by adjusting at least one of the thermal transfer

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media temperature and the thermal transfer media flow rate (col. 5, lines 27-48). **Muller** also discloses that the process energy (i.e. RF power) can be adjusted to control the temperature (col. 6, lines 15-26) and

**Muller** does not specifically state that when adjusting at least one of the thermal transfer media temperature and the thermal transfer media flow rate cannot bring the sensed temperature within the desired temperature range, then the controller controls the sensed temperature by additionally adjusting the process energy.

However, it would have been obvious for one of ordinary skill in the art, at the time of the invention to first adjust the thermal transfer media flow rate or temperature before adjusting the process energy in order to maintain a higher etching rate and thereby faster processing and faster throughput of the semiconductor devices, which is always highly desired in the semiconductor fabrication art.

Further in this regard, it has been held that the selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

Regarding claim 7, **Muller** discloses the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy to cool the chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 6, lines 14-26; col. 6, lines 54-65).

Regarding claim 8, **Muller** discloses the controller is used to adjust at least one of the thermal transfer media flow rate, the thermal transfer media temperature, and the process energy



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to heat the chuck and the substrate and thereby to bring the sensed temperature within the desired temperature range (col. 6, lines 14-26; col. 6, lines 54-65).

### *Conclusion*

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,508,934 (**Moslehi** et al.) discloses control of wafer temperature using pyrometer feedback control of heating lamp energy.

US 5,435,379 (**Moslehi** et al.) anticipates at least claims 1, 3, 7, and 8 (Abstract; Fig. 3; col. 3, line 42 to col. 4, line 7).

US 6,081,414 (**Flanigan** et al.) anticipates at least claims 1-3, 7, and 8 (Abstract; Figs. 2-3; col. 5, lines 31-50).

US 6,583,638 B2 (**Costello** et al.) anticipates at least claims 1-3, 7, and 8 (Abstract; all Figs.).

US 5,478,429 (**Komino** et al.; Abstract; col. 12, line 50 to col. 13, line 3) and US 5,584,971 (**Komino** et al.; col. 21) each anticipate at least claims 1, 3, 7, and 8.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the

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organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Erik Kielin  
Primary Examiner  
Art Unit: 2813  
July 30, 2003